BIBLIOGRAPHY OF NATURAL TELEOLOGY
AND NON-DARWINIAN EVOLUTION
(with Emphasis on Modern Studies*)

Compiled by *James Barham*

(*for the older organicist/vitalist tradition,
as well as predominantly philosophical studies,
see J. Barham, "Back to the Stoics," Appendix)

I. Histories

Blandino, G. (1969) *Theories on the Nature of Life*. New York: Philosophical Library. (Originally published in Italian)

Bloch, O. (ed.) (2000) *Philosophies de la nature.* Paris: Publications de la Sorbonne.

Bowler, P.J. (1988) *The Non-Darwinian Revolution*. Baltimore: Johns Hopkins University Press.

Burwick, F. and P. Douglass (eds.) (1992) *The Crisis in Modernism: Bergson and the Vitalist Controversy*. Cambridge: Cambridge University Press.

Cimino, G. and F. Duchesneau (1997) *Vitalisms from Haller to the Cell Theory*. Florence: Leo S. Olschki Editore.

Driesch, H. (1914) *The History and Theory of Vitalism.* London: Macmillan and Co. (Originally published in German in 1905)

Gilson, E. (1984) *From Aristotle to Darwin and Back Again.* Notre Dame, IN: University of Notre Dame Press. (Originally published in French in 1971)

Haraway, D.J. (1976) *Crystals, Fabrics, and Fields: Metaphors of Organicism in Twentieth-Century Developmental Biology.* New Have, CT: Yale University Press.

McDougall, W. (1938) *The Riddle of Life: A Survey of Theories.* London: Methuen.

Nordenskiöld, E. (1928) *The History of Biology*. New York: Knopf. (Originally published in Swedish in 1924)

Pichot, A. (1993) *Histoire de la notion de la vie.* Paris: Gallimard.

Reid, R.G.B. (1985) *Evolutionary Theory: The Unfinished Synthesis*. Ithaca, NY: Cornell University Press.

Russell, E.S. (1982) *Form and Function: A Contribution to the Study of Animal Morphology.* Chicago: University of Chicago Press. (Originally published in 1916)

Smith, C.U.M. (1976) *The Problem of Life.* New York: John Wiley & Sons.

Stallknecht, N.P. (1934) *Studies in the Philosophy of Creation*. Princeton: Princeton University Press.

II. General Reflections on Teleology and Life

Agar, W.E. (1951) *A Contribution to the Theory of the Living Organism,* 2nd ed. Melbourne: Melbourne University Press. (1st ed., 1943)

Asma, S.T. (1996) *Following Form and Function: A Philosophical Archaeology of Life Science.* Evanston, IL: Northwestern University Press.

Canguilhem, G. (1989) *La connaissance de la vie,* 2nd ed. Paris: Vrin. (1st ed., 1952)

Cangulhem, G. (1994) *A Vital Rationalist: Selected Writings from Georges Canguilhem.* New York: Zone Books.

Cuénot, L. (1941) *Invention et finalité en biologie.* Paris: Flammarion.

Driesch, H. (1979) *The Science and Philosophy of the Organism*, 2 vols. New York: AMS. (Originally published in 1908)

Elsasser, W. (1998) *Reflections on a Theory of Organisms.* Baltimore: Johns Hopkins University Press. (Originally published in 1987)

Haldane, J.S. (1917) *Organism and Environment*. New Haven, CT: Yale University Press.

Harold, F.M. (2001) *The Way of the Cell.* New York: Oxford University Press.

Henderson, L.J. (1971) *The Order of Nature.* Freeport, NY: Books for Libraries Press. (Originally published in 1917)

Janet, P. (1878) *Final Causes*. Edinburgh: T. & T. Clark. (Originally published in French in 1876)

Jennings, H.S. (1970) *The Fitness of the Environment*. Gloucester, MA: Peter Smith. (Originally published in 1913)

Jennings, H.S. (1971) *The Universe and Life*. Freeport, NY: Books for Libraries Press. (Originally published in 1933)

Jonas, H. (1982) *The Phenomenon of Life.* Chicago: University of Chicago Press. (Originally published in 1966)

Langer, S.K. (1967--1982) *Mind: An Essay on Human Feeling,* 3 vols. Baltimore: Johns Hopkins University Press.

Le Dantec, F. (1907) *The Nature and Origin of Life in the Light of New Knowledge*. London: Hodder and Stoughton. (Originally published in French)

Lillie, R.S. (1945) *General Biology and Philosophy of the Organism*. Chicago: University of Chicago Press.

Margulis, L. and D. Sagan (1995) *What Is Life?* New York: Simon & Schuster.

Murphy, M.P. and L.A.J. O'Neill (eds.) (1995) *What Is Life? The Next Fifty Years*. Cambridge: Cambridge University Press.

Needham, J. (1930) "Organicism in Biology," in J. Needham, *The Sceptical Biologist*. New York: W. W. Norton & Company, pp. 69--86.

Needham, J. (1968) *Order and Life.* Cambridge, MA: MIT Press. (Originally published in 1936)

Needham, J. (1986) *Time, The Refreshing River*. Nottingham, U.K.: Spokesman. (Originally published in 1943)

Pepper, S.C. (1942) "Organicism," in S.C. Pepper, *World Hypotheses*. Berkeley, CA: University of California Press, pp. 280--314.

Rensch, B. (1985) *Biophilosophical Implications of Inorganic and Organic Evolution.* Essen, Germany: Verlag Der Blaue Eule.

Rignano, E. (1930) *The Nature of Life*. New York: Harcourt, Brace and Company. (Originally published in Italian)

Ritter, W.E. (1919) *The Unity of the Organism,* 2 vols. Boston: Gorham Press.

Ritter, W.E. and E.W. Bailey (1929) "The Organismal Conception: Its Place in Science and Its Bearing on Philosophy," *University of California Publications in Zoology* 30: 307--358.

Rizzotti, M. (ed.) (1996) *Defining Life: The Central Problem of Theoretical Biology*. Padua: Università di Padova.

Rothman, W. (2002) *Lessons from the Living Cell: The Limits of Reductionism.* New York: McGraw-Hill.

Russell, E.S. (1924) *The Study of Living Things: Prolegomena to a Functional Biology.* London: Methuen & Co.

Russell, E.S. (1945) *The Directiveness of Organic Activities*. Cambridge: Cambridge University Press.

Sinnott, E.W. (1955) *The Biology of the Spirit*. New York: Viking Press.

Sinnott, E.W. (1961) *Cell and Psyche: The Biology of Purpose.* New York: Harper Torchbooks. (Originally published in 1950)

Smuts, H.C. (1996) *Holism and Evolution*. Highland, NY: Highland Journal Press. (Originally published in 1926)

Vernet, M. (1947) *Le problème de la vie.* Paris: Plon.

Vernet, M. (1958) *La vie et son mystère*. Paris: Grasset.

Vertosick, F.T. (2002) *The Genius Within: Discovering the Intelligence of Every Living Thing.* New York: Harcourt, Inc.

von Uexküll, J. (1926) *Theoretical Biology.* New York: Harcourt, Brace and Company. (Originally published in German)

Waddington, C.H. (1962) *The Nature of Life.* New York: Atheneum.

Weiss, P.A. (1973) *The Science of Life.* Mt. Kisco, NY: Futura Publishing Company.

Woodger, J.H. (1929) *Biological Principles*. New York: Harcourt, Brace and Company.

III. Evolution

Bateson, W. (1894) *Materials for the Study of Variation, Treated with Especial Regard to Discontinuity in the Origin of Species.* London: Macmillan and Co.

Berg, L.S. (1969) *Nomogenesis, or Evolution Determined by Law*. Cambridge, MA: MIT Press. (Originally published in Russian in 1922; English translation originally published in 1926)

Cope, E.D. (1887) *The Origin of the Fittest*. New York: D. Appleton and Company.

Croizat, L. (1962) *Space, Time, Form: The Biological Synthesis*. Caracas: published by the author.

Cuénot, L. (1925) *L'adaptation.* Paris: Librairie Octave Doin.

Eimer, G.H.T. (1890) *Organic Evolution as a Result of the Inheritance of Acquired Characters according to the Laws of Growth.* London: Macmillan. (Originally published in German in 1888)

Eimer, G.H.T (1898) *On Orthogenesis and the Impotence of Natural Selection in Species-Formation.* Chicago: Open Court. (Originally published in German in 1896)

Giard, A. (1904) *Controverses transformistes.* Paris: C. Naud.

Grassé, P.-P. (1977) *Evolution of Living Organisms: Evidence for a New Theory of Transformation.* New York: Academic Press. (Originally published in French in 1973)

Ho, M.-W. and S. Fox (eds.) (1988) *Evolutionary Processes and Metaphors.* Chichester, UK: Wiley.

Ho, M.-W. and P.T. Saunders (eds) 1984) *Beyond Neo-Darwinism: An Introduction to the New Evolutionary Paradigm.* London: Academic.

Kellogg, V.L. (1908) *Darwinism To-Day: A Discussion of Present-Day Scientific Criticism of the Darwinian Selection Theories, Together with a Brief Account of the Principal Other Proposed Auxiliary and Alternative Theories of Species-Forming.* New York: Henry Holt and Company.

Lima-de-Faria, A. (1988) *Evolution without Selection: Form and Function by Autoevolution.* Amsterdam: Elsevier.

Løvtrup, S. (1987) *Darwinism: The Refutation of a Myth.* London: Croom Helm.

Mebane, A. (1994*) Darwin's Creation-Myth: What It Is, How It Has Proved "Unfit," Why It Survives.* Venice, FL: P & D Printing. (Available from the author, Alexander Mebane, 238 W. Tampa Ave., #307, Venice, FL 34285)

Mivart, St.G. (1871) *On the Genesis of Species*. New York: D. Appleton and Company.

Riedl, R. (1978) *Order in Living Organisms: A Systems Analysis of Evolution.* Chichester, UK: John Wiley & Sons. (Originally published in German in 1975)

Robson, G.C. and O.W. Richards (1936) *The Variation of Animals in Nature*. London: Longmans, Green and Company.

Rosa, D. (1931) *L'ologénèse: nouvelle théorie de l'évolution et de la distribution géographique*. Paris: Librairie Félix Alcan. (Originally published in Italian in 1918)

Schoffeniels, E. (1976) *Anti-Chance,* Pergamon, Oxford. (Originally published in French in 1975)

Severtsov (Sewertzoff), A.N. (1931) *Morphologische Gesetzmässigkeiten der Evolution*. Jena: Gustav Fischer.

von Baer, K.E. (1873) "Ueber Darwins Lehre," in K.E. von Baer, *Reden gehalten in wissenschaftlichen Versammlungen und kleinere Aufsätze vermischten Inhalts. Zweiter Theil, erste Hälfte: Studien aus dem Gebiete der Naturwissenschaften.* St. Petersburg: Verlag der kaiserlichen Hofbuchhandlung H. Schmitzdorff, pp. 235--480.

von Nägeli, C. (1914) *A Mechanico-Physiological Theory of Organic Evolution*, 2nd ed. Chicago: Open Court. (Originally published in German; English translation first published in 1898)

Waddington, C.H. (1975) *The Evolution of an Evolutionist.* Ithaca, NY: Cornell University Press.

Wesson, R. (1991) *Beyond Natural Selection*. Cambridge, MA: Bradford Books/MIT Press.

Whyte, L.W. (1965) *Internal Factors in Evolution.* New York: George Braziller.

Willey, B. (1960) *Darwin and Butler: Two Versions of Evolution*. New York: Harcourt, Brace and Company.

Willis, J.C. (1940) *The Course of Evolution by Differentiation or Divergent Mutation Rather Than by Selection.* Cambridge: Cambridge University Press.

Wintrebert, P. (1962) *Le vivant, créateur de son évolution*. Paris: Masson et Compagnie.

IV. Genetics and Epigenetics

Avital, E. and E. Jablonka (2000) *Animal Traditions: Behavioural Inheritance in Evolution.* Cambridge: Cambridge University Press.

Beloussov, L.V. (1998) *The Dynamic Architecture of a Developing Organism: An Interdisciplinary Approach to the Development of Organisms*. Dordrecht, Holland: Kluwer Academic.

Caporale, L.H. (ed.) (1999) *Molecular Strategies in Biological Evolution (Annals of the New York Academy of Sciences, vol. 870).* New York: New York Academy of Sciences.

Conway Morris, S. (2000) "Evolution: Bringing Molecules into the Fold," *Cell* 100: 1--11.

Emlen, J.M., D.C. Freeman, A. Mills, and J.H. Graham (1998) "How Organisms Do the Right Thing: The Attractor Hypothesis," *Chaos* 8: 717--726.

Gilbert, S.F., J.M. Opitz, and R.A. Raff (1996) "Resynthesizing Evolutionary and Developmental Biology," *Developmental Biology* 173: 357--372.

Gilbert, S.F. and S. Sarkar (2000) "Embracing Complexity: Organicism for the 21st Century," *Developmental Dynamics* 219: 1--9.

Gordon, R. (1999) *The Hierarchical Genome and Differentiation Waves,* 2 vols. Singapore: World Scientific.

Gottlieb, G. (1992) *Individual Development and Evolution: The Genesis of Novel Behavior.* New York: Oxford University Press.

Hall, B.G. (1998) "Adaptive Mutagenesis: A Process That Generates Almost Exclusively Beneficial Mutations," *Genetica* 102/103: 109--125.

Jablonka, E. and M.J. Lamb (1995) *Epigenetic Inheritance and Evolution: The Lamarckian Perspective*. Oxford: Oxford University Press.

Johnston, T.D. and G. Gottlieb (1990) "Neophenogenesis: A Developmental Theory of Phenotypic Evolution," *Journal of Theoretical Biology* 147: 471--495.

Keller, E.F. (2000) *The Century of the Gene.* Cambridge, MA: Harvard University Press.

Kirschner, M., J. Gerhart, and T. Mitchison (2000) "Molecular 'Vitalism,'" *Cell* 100: 79--88.

Lewontin, R. (2000) *The Triple Helix*. Cambridge, MA: Harvard University Press.

Løvtrup, S. (1974) *Epigenetics: A Treatise on Theoretical Biology.* London: John Wiley & Sons.

Margulis, L. and D. Sagan (2002) *Acquiring Genomes: A Theory of the Origins of Species*. New York: Basic Books.

Moss, L. (2002) *What Genes Can't Do*. Cambridge, MA: Bradford Books/MIT Press.

Oyama, S. (1985) *The Ontogeny of Information: Developmental Systems and Evolution.* Cambridge: Cambridge University Press.

Oyama, S. (2000) *Evolution's Eye: A Systems View of the Biology-Culture Divide*. Durham, NC: Duke University Press.

Oyama, S., P.E. Griffiths, and R.D. Gray (eds.) (2001) *Cycles of Contingency: Developmental Systems and Evolution.* Cambridge, MA: Bradford Books/MIT Press.

Salthe, S.N. (1993) *Development and Evolution: Complexity and Change in Biology.* Cambridge, MA: Bradford Books/MIT Press.

Shapiro, J.A. (1997) "Genome Organization, Natural Genetic Engineering and Adaptive Mutation," *Trends in Genetics* 13: 98--104.

Shapiro, J.A. (1999a) "Genome System Architecture and Natural Genetic Engineering in Evolution," in L.H. Caporale (ed.) (1999) *Molecular Strategies in Biological Evolution (Annals of the New York Academy of Sciences, vol. 870).* New York: New York Academy of Sciences, pp. 23--35.

Shapiro, J.A. (1999b) "Transposable Elements as the Key to a 21st Century View of Evolution," *Genetica* 107: 171--179.

Shapiro, J.A. (2002) "A 21st Century View of Evolution," *Journal of Biological Physics* 28: 1--20. (Also available at http://shapiro.bsd.uchicago.edu/21st_Cent_View_Evol.html)

Steele, E.J., R.A. Lindley, and R.V. Blanden (1998) *Lamarck's Signature: How Retrogenes Are Changing Darwin's Natural Selection Paradigm.* Reading, MA: Perseus Books.

van der Weele, C. (1999) *Images of Development: Environmental Causes of Ontogeny.* Albany, NY: State University of New York Press.

von Bertalanffy, L. (1962) *Modern Theories of Development.* New York: Harper Torchbooks. (Originally published in German in 1928; English translation originally published in 1933)

von Sternberg, R. (1996a) "The Role of Constrained Self-Organization in Genome Structural Evolution," *Acta Biotheoretica* 44, 95--118.

von Sternberg, R. (1996b) "Genome Self-Modification and Cellular Control of Genome Reorganization," *Rivista di Biologia* 89, 445--484.

von Sternberg, R. (2000) "Genomes and Form: The Case for Teleomorphic Recursivity," in J.L.R. Chandler and G. Van de Vijver (eds.), *Closure: Emergent Organizations and Their Dynamics (Annals of the New York Academy of Sciences, vol. 901).* New York: New York Academy of Sciences, pp. 224--236.

Waddington, CH. (1957) *The Strategy of the Genes: A Discussion of Some Aspects of Theoretical Biology.* London: George Allen & Unwin.

V. Structuralist, Mathematical, and Computational Approaches

Arber, A. (1950) *The Natural Philosophy of Plant Form.* Cambridge: Cambridge University Press.

Bonabeau, E., M. Dorigo, and G. Theraulaz (1999) *Swarm Intelligence: From Natural to Artificial Systems.* New York: Oxford University Press.

Camazine, S., J.-L. Deneubourg, N.R. Franks, J. Sneyd, G. Theraulaz, and E. Bonabeau (2001) *Self-Organization in Biological Systems.* Princeton: Princeton University Press.

Casti, J. and A. Karlqvist (eds.) (1989*) Newton to Aristotle: Towards a Theory of Models for Living Systems*. Boston: Birkhäuser.

Cowan, G.A., D. Pines, and D. Meltzer (eds.) (1994) *Complexity: Metaphors, Models, and Reality*. Reading, MA: Addison-Wesley.

Fontana, W. and L.W. Buss (1994a) "'The Arrival of the Fittest: Towards a Theory of Biological Organization," *Bulletin of Mathematical Biology* 56: 1--64.

Fontana, W. and L.W. Buss (1994b) "What Would Be Conserved If 'the Tape Were Played Twice'?," *Proceedings of the National Academy of Sciences* 91: 757--761.

Fontana, W. and L.W. Buss (1996) "The Barrier of Objects: From Dynamical Systems to Bounded Organizations," in J.L. Casti and A. Karlqvist (eds.), *Boundaries and Barriers: On the Limits of Scientific Knowledge*." Reading, MA: Addison-Wesley, pp. 55--115.

Fontana, W. and L.W. Buss (1996) "Towards a Theory of Biological Organization: A Programmatic Statement." www.santafe.edu/~walter/AlChemy/Statement/ organization.html

Fontana, W., G. Wagner, and L.W. Buss (1995) "Beyond Digital Naturalism," in C.G. Langton (ed.), *Artificial Life: An Overview*. Cambridge, MA: Bradford Books/MIT Press, pp. 211--227. (Originally published in 1994)

Goodwin, B. (1994) *How the Leopard Changed Its Spots: The Evolution of Complexity.* New York: Charles Scribner's Sons.

Goodwin, B. and P. Saunders (eds.) (1992) *Theoretical Biology: Epigenetic and Evolutionary Order from Complex Systems*. Baltimore: Johns Hopkins University Press. (Originally published in 1989)

Goodwin, B., A. Sibatani, and G. Webster (eds.) (1989) *Dynamic Structure in Biology.* Edinburgh: Edinburgh University Press.

Hahn, W. (1998) *Symmetry as a Developmental Principle in Nature and Art.* Singapore: World Scientific. (Originally published in German)

Hahn, W. and P. Weibel (eds.) (1996) *Evoluntionäre Symmetrietheorie: Selbstorganisation und dynamische Systeme.* Stuttgart: S. Hirzel.

Hyde, S., S. Andersson, K. Larsson, Z. Blum, T. Landh, S. Lidin, and B.W. Ninham (1997) *The Language of Shape. The Role of Curvature in Condensed Matter: Physics, Chemistry and Biology*. Amsterdam: Elsevier.

Kauffman, S.A. (1993) *The Origins of Order: Self-Organization and Selection in Evolution*. New York: Oxford University Press.

Kauffman, S.A. (2000) *Investigations.* New York: Oxford University Press.

Mainzer, K. (1996) *Symmetries of Nature: A Handbook for Philosophy of Nature and Science.* Berlin: Walter de Gruyter. (Originally published in German in 1988)

McGhee, G.R. (1999) *Theoretical Morphology.* New York: Columbia University Press.

Meinhardt, H. (1995) *The Algorithmic Beauty of Sea Shells.* Berlin: Springer.

Mittenthal, J.E. and A.B. Baskin (eds.) (1992) *The Principles of Organization in Organisms*. Reading, MA: Addison-Wesley.

Murray, J.D. (1997) *Mathematical Biology,* 2nd ed. New York: Springer. (1st ed., 1989)

Nijhout, H.F., L. Nadel, and D.L. Stein (eds.) (1997) *Pattern Formation in the Physical and Biological Sciences.* Reading, MA: Addison-Wesley.

Prusinkiewicz, P. and A. Lindenmayer (1990) *The Algorithmic Beauty of Plants.* New York: Springer.

Rosen, R. (1991) *Life Itself: A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life.* New York: Columbia University Press.

Rosen, R. (2000) *Essays on Life Itself.* New York: Columbia University Press.

Schmidt-Kittler, N. and K. Vogel (eds.) (1991) *Constructional Morphology and Evolution.* Berlin: Springer.

Stein, W. and F.J. Varela (eds.) (1993) *Thinking about Biology: An Invitation to Current Theoretical Biology.* Reading, MA: Addison-Wesley.

Thom, R. (1989) *Mathematical Stability and Morphogenesis*. Redwood City, CA: Addison-Wesley. (Originally published in 1975)

Thom, R. (1990) *Semiophysics.* Redwood City, CA: Addison-Wesley. (Originally published in French in 1988)

Thomas, R.D.K. and W.E. Reif (1993) "The Skeleton Space: A Finite Set of Organic Designs," *Evolution* 47: 341--360.

Thompson, D.W. (1992) *On Growth and Form.* New York: Dover Publications. (Originally published in 1917; rev. ed., 1942)

Waddington, C.H. (1977) *Tools for Thought*. New York: Basic Books.

Webster, G. and B. Goodwin (1996) *Form and Transformation: Generative and Relational Principles in Biology.* Cambridge: Cambridge University Press.

VI. Reductionism and Emergence

Andersen, P.B., C. Emmeche, N.O. Finnemann, and P.V. Christiansen (eds.) (2000) *Downward Causation.* Aarhus, Denmark: Aarhus University Press.

Anderson, P.W. (1972) "More Is Different," *Science* 177: 393--296.

Anderson, P.W. (1995) "Historical Overview of the Twentieth Century in Physics," in L.M. Brown, A. Pais, and B. Pippard (eds.), *Twentieth Century Physics,* 3 vols. New York: American Institute of Physics, Vol. 3, pp. 2017--2032.

Anderson, P.W. (2001) "More Is Different---One More Time," in N.P. Ong and R.N. Bhatt (eds.), *More Is Different: Fifty Years of Condensed Matter Physics.* Princeton: Princeton University Press, pp. 1--8.

Batterman, R.W. (2002) *The Devil in the Details: Asymptotic Reasoning in Explanation, Reduction, and Emergence.* New York: Oxford University Press.

Beckermann, A., H. Flohr, and J. Kim (eds.) (1992) *Emergence or Reduction?* Berlin: Walter de Gruyter.

Blitz, D. (1992) *Emergent Evolution*. Dordrecht, Holland: Kluwer Academic.

Cao, T.Y. (1998) "Monism, but Not Through Reductionism," in R.S. Cohen and A.I. Tauber (eds.), *Philosophies of Nature: The Human Dimension*. Dordrecht, Holland: Kluwer Academic, pp. 39--51.

Denbigh, K.G. (1975) *An Inventive Universe.* New York: George Braziller.

Dresden, M. (1974) "Reflections on 'Fundamentality and Complexity,'" in C.P. Enz and J. Mehra (eds.), *Physical Reality and Mathematical Description.* Dordrecht, Holland: D. Reidel Publishing Company, pp. 133--166.

Dresden, M. (1998) "Fundamentality and Numerical Scale---Diversity and the Structure of Physics," *American Journal of Physics* 66: 468--482.

Ekeland, I. (1988) *Mathematics and the Unexpected*. Chicago: University of Chicago Press. (Originally published in French in 1984)

Favre, A., H. Guitton, J. Guitton, A. Lichnerowicz, and E. Wolff (1995) *Chaos and Determinism: Turbulence as a Paradigm for Complex Systems Converging toward Final States*. Baltimore: Johns Hopkins University Press. (Originally published in French in 1988)

Freeman, W.J. (1999) "Consciousness, Intentionality, and Causality," in R. Núñez and W.J. Freeman (eds.), *Reclaiming Cognition*. Bowling Green, OH: Imprint Academic, pp. 143--172. (*Journal of Consciousness Studies* 6: 143--172).

Ho, M.-W. (1996) "The Biology of Free Will," *Journal of Consciousness Studies* 3: 231--244.

Laughlin, R.B. and D. Pines (2000) "The Theory of Everything," *Proceedings of the National Academy of Sciences, USA* 97: 28--31.

Laughlin, R.B., G.G. Lonzarich, P. Monthoux, and D. Pines (2001) "The Quantum Criticality Conundrum," *Advances in Physics* 50: 361--365.

Lestienne, R. (1995) *The Children of Time: Causality, Entropy, Becoming*. Urbana, IL: University of Illinois Press. (Originally published in French in 1990)

Novikoff, A.B. (1945) "The Concept of Integrative Levels and Biology," *Science* 101: 209--215.

Pomian, K. (ed.) (1990) *La querelle du déterminisme*. Paris: Le Débat/Gallimard.

Prigogine, I. (1997) *The End of Certainty*. New York: Free Press. (Originally published in French in 1996.)

I. Prigogine (ed.) (2001) *L'homme devant l'incertain*. Paris: Editions Odile Jacob.

I. Prigogine and I. Stengers (1984) *Order out of Chaos: Man's New Dialogue with Nature*. New York: Bantam Books. (Originally published in French)

Primas, H. (1991) "Reductionism: Palaver without Precedent," in E. Agazzi (ed.), *The Problem of Reductionism in Science*. Dordrecht, Holland: Kluwer Academic, pp. 161--172.

Rueger, A. (2000) "Robust Supervenience and Emergence," *Philosophy of Science* 67: 466--489.

Schweber, S.S. (1993) "Physics, Community and the Crisis in Physical Theory," *Physics Today* 46(11): 34--40.

Schweber, S.S. (1997) "The Metaphysics of Science at the End of a Heroic Age," in R.S. Cohen, M. Horne, and J. Stachel (eds.), Experimental Metaphysics. Dordrecht, Holland: Kluwer Academic, pp. 171--198.

Scott, A. (1995) *Stairway to the Mind*. New York: Copernicus/Springer.

Silberstein, M. (2001) "Converging on Emergence: Consciousness, Causation, and Explanation," *Journal of Consciousness Studies* 8: 61--98.

West, B.J. (1985) *An Essay on the Importance of Being Nonlinear*. Berlin: Springer-Verlag.

West, B.J. (1990) "The Disproportionate Response," in R.E. Mickens (ed.), *Mathematics and Science.* Singapore: World Scientific, pp. 258--290.

VII. Physical Approaches

Black, S. (1972) *The Nature of Living Things*. London: Martin Secker & Warburg.

Careri, G. (1984) *Order and Disorder in Matter*. Menlo Park, CA: Benjamin/Cummings Publishing Company. (Originally published in Italian)

Davydov, A.S. (1982) *Biology and Quantum Mechanics.* Oxford: Pergamon. (Originally published in Russian)

Del Giudice, E., S. Doglia, M. Milani, and G. Vitiello (1986a) "Spontaneously Broken Symmetries and Dissipative Structures," in C.W. Kilmister (ed.), *Disequilibrium and Self-Organization.* Dordrecht, Holland: D. Reidel Publishing Company, pp. 197--205.

Del Giudice, E., S. Doglia, M. Milani, and G. Vitiello (1986b) "Collective Properties of Biolgical Systems: Solitons and Coherent Electric Waves in a Quantum Field Theoretic Approach," in F. Gutmann and H. Keyzer (eds.), Modern Bioelectrochemistry. New York: Plenum Press, pp. 263--287.

Del Giudice, E., S. Doglia, M. Milani, and G. Vitiello (1988) "Structures, Correlations and Electromagnetic Interactions in Living Matter: Theory and Applications," in H. Fröhlich (ed.), Biological Coherence and Response to External Stimuli. Berlin: Springer, pp. 49--64.

Del Giudice, E., S. Doglia, and G. Vitiello (1989) "Self-Organization and Symmetry Breaking in Living Matter," in B. Gruber and F. Iachello (eds.), Symmetries in Science III. New York: Plenum Press, pp. 379--387.

Del Giudice, E. and G. Preparata (1995) "Coherent Dynamics of Water as a Possible Explanation of Biological Membranes Formation," *Journal of Biological Physics* 20: 105--116.

Flyvbjerg, H., Hertz, J., Jensen, M.H., Mouritsen, O.G., and Sneppen, K. (eds.) (1997) *Physics of Biological Systems.* Berlin: Springer.

Frauenfelder, H. (1995a) "Proteins---Paradigms of Complex Systems," *Experientia* 51: 200--203.

Frauenfelder, H. (1995b) "Proteins and the Physics of Complexity," in M. Peyrard (ed.), *Nonlinear Excitations in Biomolecules (Les Houches, 1994)*. Berlin: Springer/Les Ulis, France: Les Editions de Physique, pp. 177--189.

Frauenfelder, H. (1997) "The Complexity of Proteins," in H. Flyvbjerg, Hertz, J., Jensen, M.H., Mouritsen, O.G., and Sneppen, K. (eds.): 1997, *Physics of Biological Systems.* Berlin: Springer, pp. 29--60.

Frauenfelder, H. and P.G. Wolynes (1994) "Biomolecules: Where the Physics of Complexity and Simplicity Meet," *Physics Today* 47(2): 58--64.

Frauenfelder, H., K. Chu, and R. Philipp (1991) "Physics from Proteins," in L. Peliti (ed.), *Biologically Inspired Physics.* New York: Plenum Press, pp. 1--14.

Frauenfelder, H., B.H. McMahon, R.H. Austin, K. Chu, and J.T. Groves (2001) "The Role of Structure, Energy Landscape, Dynamics, and Allostery in the Enzymatic Function of Myoglobin," *Proceedings of the National Academy of Sciences, USA* 98: 2370--2374.

Frauenfelder, H. S.G. Sligar, and P.G. Wolynes (1991) "The Energy Landscapes and Motions of Proteins," *Science* 254: 1598--1603.

Frauenfelder, H., P.G. Wolynes, and R.H. Austin (1999) "Biological Physics," *Reviews of Modern Physics* 71: S419--S430.

Fröhlich, F. and G.J. Hyland (1995) "Fröhlich Coherence at the Mind-Brain Interface," in J. King and K.H. Pribram (eds.), *Scale in Conscious Experience*. Mahwah, NJ: Lawrence Erlbaum Associates, pp. 407--438.

Fröhlich, H. (1968) "Long-Range Coherence and Energy Storage in Biological Systems," *International Journal of Quantum Chemistry* 2: 641--649.

Fröhlich, H. (1969) "Quantum Mechanical Concepts in Biology," in M. Marois (ed.), *Theoretical Physics and Biology*. Amsterdam: North-Holland, pp. 13--22.

Fröhlich, H. (1986a) "Coherent Excitations in Active Biological Systems," in F. Gutmann and H. Keyzer (eds.), Modern Bioelectrochemistry. New York: Plenum Press, pp. 241--261.

Fröhlich, H. (1986b) "Coherence and the Action of Enzymes," in G.R. Welch (ed.), *The Fluctuating Enzyme*. New York: Wiley, pp. 421--449.

Fröhlich, H. (ed.) (1988) *Biological Coherence and Response to External Stimuli*. Berlin: Springer.

Fröhlich, H. and F. Kremer (eds.) (1983) *Coherent Excitations in Biological Systems*. Berlin: Springer.

Haken, H. (1981) *The Science of Structure: Synergetics.* New York: Von Nostrand Reinhold. (Originally published in German)

Haken, H.(1983) *Synergetics,* 3rd ed. Springer: Berlin.

Ho, M.-W. (1996) "Organisms as Polyphasic Liquid Crystals," *Bioelectrochemistry and Bioenergetics* 41: 81--91.

Ho, M.-W. (1997) "Towards a Theory of the Organism*," Integrative Physiological and Behavioral Science* 32: 343--363.

Ho, M.-W. (1998) *The Rainbow and the Worm: The Physics of Organisms,* 2nd ed. Singapore: World Scientific. (1st ed., 1993)

Insinna, E.M., P. Zaborski, and J. Tuszynski (1996) "Electrodynamics of Microtubular Motors: The Building Blocks of a New Model," *BioSystems* 39: 187--226.

Katchalsky, A. (1971) "Thermodynamics of Flow and Biological Organization," *Zygon* 6: 99--125.

Laughlin, R.B., D. Pines, J. Schmalian, B.P. Stojković, and P. Wolynes (2000) "The Middle Way," *Proceedings of the National Academy of Sciences, USA* 97: 32--37.

Leduc, S. (1911) *The Mechanism of Life.* New York: Rebman Company. (Originally published in French)

Lumsden, C.J., W.A. Brandts, and L.E.H. Trainor (eds.) (1997) *Physical Theory in Biology*. Singapore: World Scientific.

Matsuno, K. (1989) *Protobiology: Physical Basis of Biology*. Boca Raton, FL: CRC Press.

McClare, C.W.F. (1971) "Chemical Machines, Maxwell's Demon and Living Organisms," *Journal of Theoretical Biology* 30: 1--34.

McClare, C.W.F. (1974) "Resonance in Bioenergetics," in D.E. Green (ed.), *The Mechanism of Energy Transduction in Biological Systems (Annals of the New York Academy of Sciences, vol. 227).* New York: New York Academy of Sciences, pp. 74--97.

Mishra, R.K. (ed.) (1990) *Moleclar and Biological Physics of Living Systems*. Dordrecht, Holland: Kluwer Academic.

Mishra, R.K., D. Maass, and E. Zwierlein (eds.) (1994) *On Self-Organization: An Interdisciplinary Search for a Unifying Perspective.* Berlin: Springer.

Morán, F., A. Moreno, E. Minch, and F. Montero (1997) "Further Steps Towards a Realistic Description of the Essence of Life," in C.G. Langton and K. Shimohara (eds.), *Artificial Life V*. Cambridge, MA: Bradford Books/MIT Press, pp. 255--263.

Moreno Bergareche, A. and K. Ruiz-Mirazo (1999) "Metabolism and the Problem of Its Universalization," *BioSystems* 49: 45--61.

Morowitz, H.J. (1999) "A Theory of Biochemical Organization, Metabolic Pathways, and Evolution," *Complexity* 4(6): 39--53.

Norris, V., M.S. Madsen, and P. Freestone (1996) "Elements of a Unifying Theory of Biology," *Acta Biotheoretica* 44: 209--218.

Pohorille, A. and M.H. New (2000) "Models of Protocellular Structures, Functions and Evolution." http://exobiology.nasa.gov/biomed/papers990823/blois.20/blois.html

Pokorný, J. and T.-M. Wu (1998) *Biophysical Aspects of Coherence and Biological Order.* Berlin: Springer.

Pollack, G.H. (2001) *Cells, Gels, and the Engines of Life.* Seattle: Ebner and Sons.

Preparata, G. (1995) *QED Coherence in Matter*. Singapore: World Scientific.

Sewell, G.L. (1986) *Quantum Theory of Collective Phenomena.* Oxford: Oxford University Press.

Stein, D.L. (ed.) (1992) *Spin Glasses and Biology.* Singapore: World Scientific.

Szent-Gyögyi, A. (1972) *The Living State.* New York: Academic Press, 1972.

Tigyi, J., M. Kellermayer, and C.F. Hazlewood (eds.) (1991) *The Physical Aspect of the Living Cell.* Budapest: Akadémiai Kiadó.

Vitiello, G. (2001) *My Double Unveiled: The Dissipative Quantum Model of Brain.* Amsterdam/Philadelphia: John Benjamins Publishing Company.

Watterson, J.G. (1991a) "Role of Water in Cell Function," *Biophysics* 36: 1--26.

Watterson, J.G. (1991b) "The Interactions of Water and Proteins in Cellular Function," in P. Jeanteur, Y. Kuchino, W.E.G. Müller, and P.L. Paine (eds.), *Progress in Molecular and Subcellular Biology, 12.* Berlin: Springer-Verlag, pp. 113--134.

Watterson, J.G. (1996) "Water Clusters: Pixels of Life," in S.R. Hameroff, A.W. Kaszniak, and A.C. Scott (eds.), *Toward a Science of Consciousness*. Cambridge, MA: Bradford Books/MIT Press, pp. 397--405.

Watterson, J.G. (1997) "The Pressure Pixel---Unit of Life?," *BioSystems* 41: 141--152.

Watterson, J.G. (2001) "Enzyme Function: Random Events or Coherent Action?" (unpublished manuscript; may be obtained by writing to the author, John G. Watterson, 18 Tomanbil Terrace, Ashmore, Queensland 2412, Australia)

Welch, G.R. (1992) "An Analogical 'Field' Construct in Cellular Biophysics: History and Present Status," *Progress in Biophysics and Molecular Biology* 57: 71--128.

VIII. Dynamical and Integrative Approaches

Albrecht-Buehler, G. (1990) "In Defense of 'Nonmolecular' Cell Biology," *International Review of Cytology* 120: 191--241.

Albrecht-Buehler, G. (2000) "Cell Intelligence." www.basic.northwestern.edu/g-buehler/cellint0.htm

Auyang, S.Y. (1998) *Foundations of Complex-System Theories in Economics, Evolutionary Biology, and Statistical Physics.* Cambridge: Cambridge University Press.

Bar-Yam, Y. (1997) *Dynamics of Complex Systems*. Reading, MA: Addison-Wesley.

Bar-Yam, Y. (ed.) (2000) *Unifying Themes in Complex Systems*. Cambridge, MA: Perseus Books.

Cohen, J. and I. Stewart (1994) *The Collapse of Chaos: Discovering Simplicity in a Complex World.* New York: Viking.

Collado-Vides, J., B. Magasanik, and T.F. Smith (eds.) (1996) *Integrative Approaches to Molecular Biology.* Cambridge, MA: MIT Press.

Coveney, P. and R. Highfield (1995) *Frontiers of Complexity: The Search for Order in a Chaotic World.* New York: Fawcett Columbine.

Delattre, P. (1986) "An Approach to the Notion of Finality according to the Concepts of Qualitative Dynamics," in S. Diner, D. Fargue, and G. Lochak (eds), *Dynamical Systems: A Renewal of Mechanism.* Singapore: World Scientific, pp. 149--154.

Freeman, W.J. (1991) "The Physiology of Perception," *Scientific American* 264(2): 78--85.

Freeman, W.J. (1995) "The Creation of Perceptual Meanings in Cortex through Chaotic Itinerancy and Sequential State Transitions Induced by Sensory Stimuli," in P. Kruse and M. Stadler (eds.), *Ambiguity in Mind and Nature*. Berlin: Springer, pp. 421--437.

Freeman, W.J. (2001) *How Brains Make Up Their Minds*. New York: Columbia University Press. (Originally published in 2000)

Glass, L. and M.C. Mackey (1988) *From Clocks to Chaos: The Rhythms of Life.* Princeton: Princeton University Press.

Goldbeter, A. (1996) *Biochemical Oscillations and Cellular Rhythms.* Cambridge: Cambridge University Press.

Harold, F.M. (1990) "To Shape a Cell: An Inquiry into the Causes of Morphogenesis of Microorganisms," *Microbiological Reviews* 54: 381--431.

Harrison, L.G. (1993) *Kinetic Theory of Living Pattern*. Cambridge: Cambridge University Press.

Juarrero, A. (1999) *Dynamics in Action.* Cambridge, MA: Bradford Books/MIT Press.

Kelso, J.A.S. (1995) *Dynamic Patterns: The Self-Organization of Brain and Behavior.* Cambridge, MA: Bradford Books/MIT Press.

Kugler, P.N. and M.T. Turvey (1987) *Information, Natural Law, and the Self-Assembly of Rhythmic Movement.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Lauffenberger, D.A. and Horwitz, A.F. (1996) "Cell Migration: A Physically Integrated Molecular Process," *Cell* 84: 359--369.

Lewin, R. (1999) *Complexity: Life at the Edge of Chaos,* 2nd ed. Chicago: University of Chicago Press. (1st ed., 1992)

Mainzer, K. (1997) *Thinking in Complexity: The Complex Dynamics of Matter, Mind, and Mankind,* 3rd ed. Berlin: Springer. (1st ed., 1994)

Mikulecky, D.C. (1995) "Topological Determinants of Dynamic Molecular Properties: A Network Thermodynamic Approach," *Journal of Molecular Structure (Theochem)* 336: 179--208.

Mikulecky, D.C. (1996) "Complexity, Communication between Cells, and Identifying the Functional Components of Living Systems: Some Observations," *Acta Biotheoretica* 44: 179--208.

Núñez, R. and W.J. Freeman (eds.) (1999) *Reclaiming Cognition*. Bowling Green, OH: Imprint Academic.

Pattee, H.H. (1982) "Cell Psychology: An Evolutionary Approach to the Symbol-Matter Problem," *Cognition and Brain Theory* 5, 325--341.

Pattee, H.H. (2001) "The Physics of Symbols: Bridging the Epistemic Cut," *BioSystems* 60: 5--21.

Port, R.F. and T. van Gelder (eds.) *Mind as Motion: Explorations in the Dynamics of Cognition.* Cambridge, MA: Bradford Books/MIT Press.

Skarda, C.A. and W.J. Freeman (1987) "How Brains Make Chaos in Order to Make Sense of the World," *Behavioral and Brain Sciences* 10: 161--195.

Solé, R. and B. Goodwin (2000) *Signs of Life: How Complexity Pervades Biology.* New York: Basic Books.

Thelen, E. and L.B. Smith (1994) *A Dynamic Systems Approach to the Development of Cognition and Action.* Cambridge, MA: Bradford Books/MIT Press.

Van de Vijver, G., S.N. Salthe, and M. Delpos (eds.) (1998) *Evolutionary Systems: Biological and Epistemological Perspectives on Selection and Self-Organization.* Dordrecht, Holland: Kluwer Academic.

Walleczek, J. (ed.) (2000) *Self-Organized Biological Dynamics and Nonlinear Control.* Cambridge: Cambridge University Press.

Winfree, A.T. (1987) *When Time Breaks Down: The Three-Dimensional Dynamics of Electrochemical Waves and Cardiac* Arrhythmias. Princeton: Princeton University Press.

Winfree, A.T. (1990) *The Geometry of Biological Time*, 2nd ed. Berlin: Springer. (1st ed., 1980)

Yates, F.E. (1987) "Quantumstuff and Biostuff: A View of Patterns of Convergence in Contemporary Science," in F.E. Yates (ed.), *Self-Organizing Systems: The Emergence of Order*. New York: Plenum Press, pp. 617--644.

Yates, F.E. (1993) "Self-Organizing Systems," in C.A.R. Boyd and D. Noble (eds.), The Logic of Life: The Challenge of Integrative Physiology. Oxford: Oxford University Press, pp. 189--218.

Yates, F.E. (1994) "Order and Complexity in Dynamical Systems: Homeodynamics as a Generalized Mechanics for Biology," *Mathematical and Computer Modelling* 19: 49--74.

Yates, F.E. (ed.) (1987) *Self-Organizing Systems: The Emergence of Order*. New York: Plenum.